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## New Combinations in *Rohdea* (Convallariaceae)

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**ABSTRACT.** Comparative survey shows that *Rohdea* differs from eight species of *Tupistra*, one species of *Campylandra* (*C. aurantiaca*), and one species of *Gonioscypha* (*G. eucomoides*) mainly by the degree of thickness of the perianth and in the shape and length of the perianth lobes. As these differences do not seem to deserve generic delimitation, those species of the last three genera are here transferred to *Rohdea*. As a consequence, the following 10 new combinations are proposed: *Rohdea aurantiaca* (Baker) N. Tanaka, *Rohdea chinensis* (Baker) N. Tanaka, *Rohdea delavayi* (Franchet) N. Tanaka, *Rohdea emeiensis* (Z. Y. Zhu) N. Tanaka, *Rohdea ensifolia* (F. T. Wang & Ts. Tang) N. Tanaka, *Rohdea eucomoides* (Baker) N. Tanaka, *Rohdea jinshanensis* (Z. L. Yang & X. G. Luo) N. Tanaka, *Rohdea longipedunculata* (F. T. Wang & S. Yun Liang) N. Tanaka, *Rohdea tonkinensis* (Baillon) N. Tanaka, and *Rohdea verruculosa* (Q. H. Chen) N. Tanaka.

**Key words:** *Campylandra*, Eastern Asia, *Gonioscypha*, *Rohdea*, *Tupistra*.

The genus *Rohdea* was first described by Roth (1821) with *R. japonica* (Thunberg) Roth from Japan. Later, five other specific names were originally published in the genus (cf. Liang, 1978; Liang & Tamura, 2000). Recent studies by Liang (1978) and Liang and Tamura (2000) recognized only one species, *R. japonica* (Fig. 1), in this genus. The five other names were either submerged in *R. japonica* or treated in other related genera (*Tupistra*, *Campylandra*). In reviewing the generic circumscription of *Rohdea*, a comparison with its allied genera *Tupistra*, *Campylandra*, and *Gonioscypha* is inevitable. *Tupistra* was described by Ker Gawler (1814) with *T. squalida* from Ambon (Amboyna), Indonesia, though its provenance is questioned (Jessop, 1979). *Campylandra* was founded by Baker (1875) with the Himalayan species *C. aurantiaca* Baker. *Tupistra* and *Campylandra* were regarded as distinct by some botanists (e.g., Baker, 1875; Engler, 1888; Hutchinson, 1934; Tamura et al., 2000), while *Campylandra* was treated as congeneric with *Tupistra* by others (e.g., Bentham, 1883; Hooker, 1892; Baillon, 1894; Liang, 1978; Huang & Li, 1990).

Under the latter view, many species with the features of *Campylandra* were described as *Tupistra* (cf. Liang & Tamura, 2000; Tamura et al., 2000). All or many of the species of *Tupistra* dealt with in many papers (e.g., Liang, 1978; Huang et al., 1989, 1990; Ma & Hong, 1990; Yang & Zhu, 1990; Huang & Hong, 1997; Li, 1997) are those corresponding with *Campylandra*.

Huang and Li (1990) subdivided *Tupistra* into two subgenera, subg. *Tupistra* and subg. *Campylandra*, the former comprising 13 species and the latter 14. Regarding *Campylandra* as a distinct genus, Tamura et al. (2000) transferred 12 species initially described under *Tupistra* and 2 species of *Rohdea* to it. Liang and Tamura (2000) recognized 16 species in all in *Campylandra*. Yamashita and Tamura (2001) recently added 1 new species to *Campylandra*, bringing the total to 17. I agree with these botanists in regarding *Campylandra* as generically distinct from *Tupistra*. *Campylandra* differs from *Tupistra* in having small trisected stigmas (Fig. 2A, C) (vs. usually moderately to largely peltate, fungilliform, or trilobed stigmas), orange to scarlet smooth pericarps (Liang, 1978; Li, 1997) (vs. dark, somewhat purplish brown to almost black, often muricate or warty pericarps) (cf. Wan, 1984; my own observations on *T. albiflora* K. Larsen and *T. fungilliformis* F. T. Wang & S. Yun Liang, of which the specimens are cited below), unimodal karyotypes (vs. bimodal karyotypes) (Huang et al., 1989, 1990; Yang & Zhu, 1990; Yang, 1995; Huang & Liu, 1996), and monosulcate ellipsoidal pollen (vs. inaperturate spheroidal pollen) (Ma & Hong, 1990; Huang & Hong, 1997).

Meanwhile, *Campylandra* was treated as distinct from *Rohdea* by many botanists (e.g., Baker, 1875; Bentham, 1883; Engler, 1888; Hutchinson, 1934; Conran & Tamura, 1998; Liang & Tamura, 2000). According to Baker (1875), *Campylandra* differs from *Rohdea* in having an elongate style (vs. almost lacking), short filaments (vs. none), and anthers located beneath the throat of the perianth tube (vs. at the throat of the tube). According to current knowledge, however, these distinctions are insignificant or partially incorrect. An indistinct style is



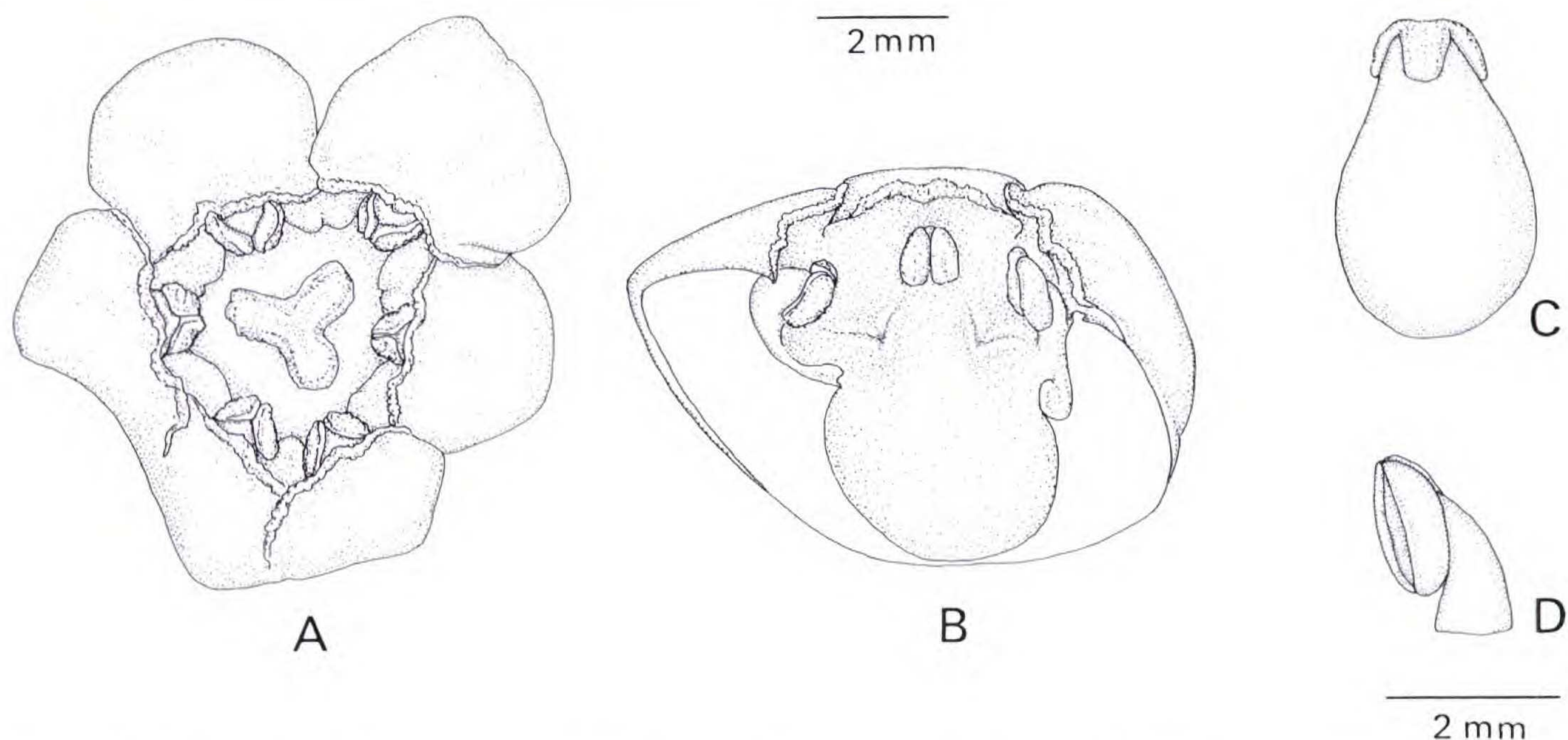


Figure 1. Flower of *Rohdea japonica*.—A. Flower in front view. —B. Flower longitudinally sectioned with pistil removed. —C. Pistil in longitudinal view. —D. Stamen in longitudinal view. A–C to same upper scale, D to lower scale. Drawn by Noriyuki Tanaka from a living plant in cultivation (N. Tanaka s.n., TEU).

also seen in some species of *Campylandra*, such as *C. siamensis* Yamashita & M. N. Tamura, *C. verruculosa* (Q. H. Chen) M. N. Tamura, S. Yun Liang & Turland, and *C. kwangtungensis* Dandy. Anthers are located at or near the throat of the tube in *C. urotepala* (Handel-Mazzetti) M. N. Tamura, S. Yun Liang & Turland, and *C. longipedunculata* (F. T. Wang & S. Yun Liang) M. N. Tamura, S. Yun Liang & Turland (Fig. 2A, B). In *Rohdea japonica*, contrary to Baker's statement, filaments are evidently present, though short, as shown in Figure 1 (A, B, and D).

Conran and Tamura (1998) reported that *Campylandra* has one stigma while *Rohdea* has three. In my examination, both genera share a trisected stigma in common (Figs. 1A, C, 2A, C). According

to Chen et al. (2000), *Rohdea* differs from *Campylandra* by its inflexed, very short perianth lobes (vs. spreading to incurved lobes, which are 1/3–1/2 as long as the tube). In their diagnosis the term “inflexed” may be used to express a more abrupt or angulated incurvature than “incurved.” *Rohdea* certainly has comparatively short perianth lobes (Fig. 1A, B), but as to their curvature, it cannot simply be said, at least at the flowering peak, that the lobes are inflexed. The perianth of *R. japonica* is incrassate (Fig. 1A, B), and the lobes are, on the ventral side, incurved to nearly erect (Fig. 1B), and on the dorsal side incurved to strongly inflexed (Fig. 1A, B). In *Campylandra*, many species (e.g., *C. longipedunculata* and *C. verruculosa*) also have perianth lobes showing incurvature at least in their

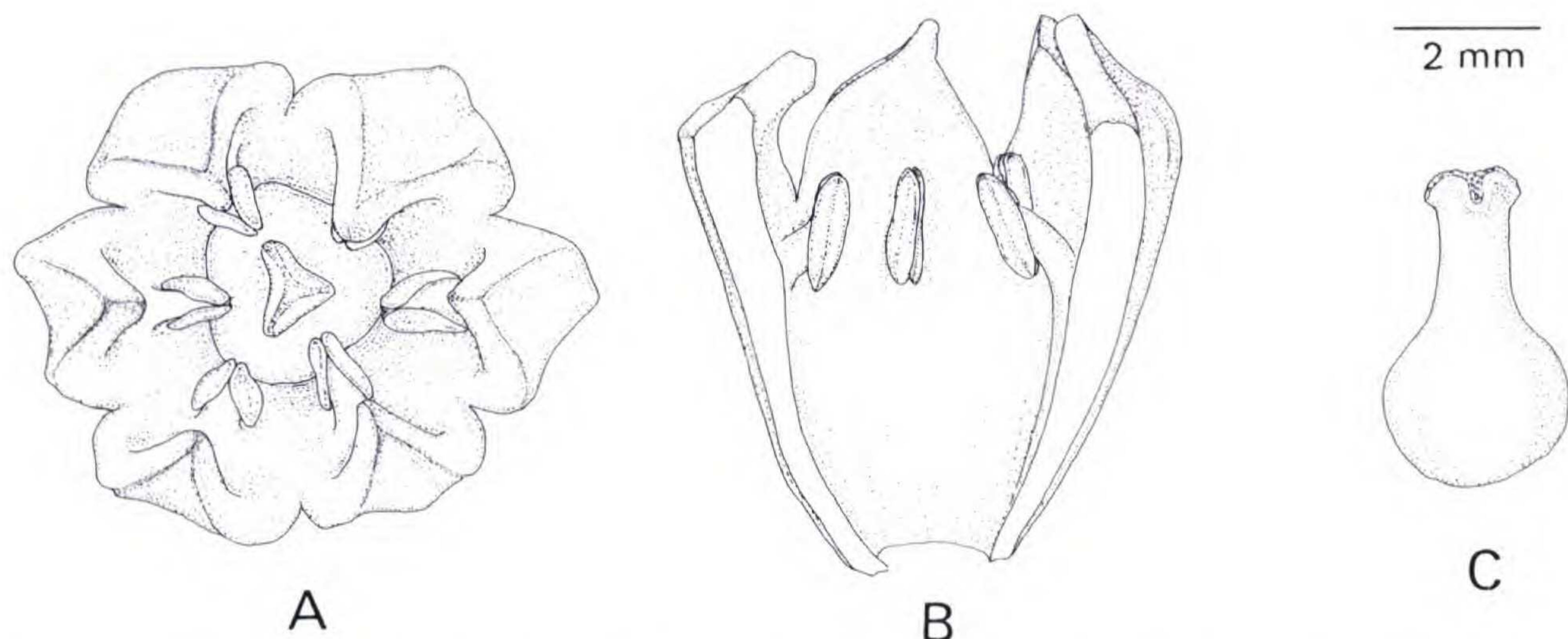


Figure 2. Flower of *Rohdea longipedunculata* (*Campylandra longipedunculata*). —A. Front view. —B. Longitudinal section with pistil removed. —C. Pistil in longitudinal view. A–C to same scale. Drawn by Noriyuki Tanaka from a living plant in cultivation, which was raised from a seed of H. Li, N. Tanaka & T. J. Xiao 356 (TEU).



upper part (Fig. 2A, B). The degree of incurvature of the perianth lobes seems, therefore, not to be decisive for distinguishing the two genera.

In my observation, *Rohdea* (*R. japonica*) differs from *Campylandra* mainly by the following features: (1) the perianth lobes are short (vs. moderately long) and truncate or subtruncate (vs. round to acuminate) at the apex, and (2) the perianth is very incrassate with the lobes (usually upper ones) particularly thickened dorsally (vs. less incrassate and less dorsally thickened) (Figs. 1A, B, 2A, B). These differences, however, seem to be insufficient for the purpose of generic separation. Among others, the second difference appears to be rather quantitative. Besides the close similarity in various organs or parts of the plants (e.g., basal two-ranked foliage leaves, flowers in a compact spike, fleshy usually greenish or yellowish perianths, small trisected stigmas, and orange to scarlet smooth pericarps), the two genera share similar unimodal karyotypes with the basic chromosome number  $x = 19$  (Yang & Zhu, 1990), and monosulcate, ellipsoidal pollen with a perforate or reticulate exine (Ma & Hong, 1990; Huang & Hong, 1997). Their close affinity is also supported from an analysis of DNA sequences of the *trnK* and *rbcL* regions of the chloroplast (Yamashita & Tamura, 2000).

The genus *Gonioscypha* was established by Baker (1875) with *G. eucomoides* Baker from Bhutan, eastern Himalaya. According to him, this species is characterized by petiolate leaves, oblong cylindrical perianth tubes, and long styles with a small capitate stigma. All these characters are, however, not significantly distinct from *Campylandra*. The capitate stigma of *Gonioscypha* is, in fact, trisected (*Kingdon-Ward 12470*, BM; *Lister 132*, K) as illustrated in plate 19 of Baker (1875) and figure 32 of Hutchinson (1934), and this feature is consistent with the stigmas of both *Campylandra* and *Rohdea*. *Campylandra delavayi* (Franchet) M. N. Tamura, S. Yun Liang & Turland and *C. fimbriata* (Handel-Mazzetti) M. N. Tamura, S. Yun Liang & Turland often have relatively broad leaf blades narrowing into a petiole, cylindrical perianth tubes, and relatively long styles, approaching the features of *G. eucomoides*. The perianth lobes of *Gonioscypha* tend to be slightly excurved below the middle (*Kingdon-Ward 12470*, BM; *Lister 132*, K). The perianth lobes of some species of *Campylandra* are also excurved or spreading at least in the lower part (e.g., *C. chinensis* (Baker) M. N. Tamura, S. Yun Liang & Turland; *C. delavayi*; *C. emeiensis* (Z. Y. Zhu) M. N. Tamura, S. Yun Liang & Turland; *C. urotepala*; *C. yunnanensis* (F. T. Wang & S. Yun Liang) M. N. Tamura, S. Yun Liang & Turland). *Gonioscypha eu-*

*comoides* can no doubt be included in *Campylandra*, and the latter is also referable to *Rohdea*, as stated above.

In *Gonioscypha* there is another species, *G. muricata* Gagnepain, described from Laos (Gagnepain, 1934). This species has pistils surpassing the stamens, small but discoid stigmas, muricate pericarps, long somewhat lax spikes, and long slender petioles (*Thorel 3314*, P). These features are coincident with some or many species of *Tupistra*, and therefore *G. muricata* is excluded from the treatment of this paper.

From the reasons stated above, nine species of *Campylandra* (cf. Liang & Tamura, 2000; Tamura et al., 2000), of which eight were originally published under *Tupistra*, and *Gonioscypha eucomoides* are transferred here to *Rohdea*.

A more detailed account of the genus *Rohdea*, including a key to the species and synonymy, is planned by the author to be published elsewhere.

***Rohdea aurantiaca*** (Baker) N. Tanaka, comb. nov. Basionym: *Campylandra aurantiaca* Baker, J. Linn. Soc., Bot. 14: 582. 1875. *Tupistra aurantiaca* (Baker) Wallich ex Hooker f., Fl. Brit. Ind. 6: 325. 1892. TYPE: India. East Himalaya, Darjiling, W. Griffith 5886 (lectotype, designated here, K).

*Other selected specimens examined.* NEPAL. [Without locality] N. Wallich s.n. (types, BM, E). SIKKIM. [Without locality] 4000–6000 ped. [ft.], J. H. Hooker s.n. (type, GH). INDIA. **Arunachal Pradesh:** East Bengal, Mishimi. W. Griffith 5888 (type, K).

***Rohdea chinensis*** (Baker) N. Tanaka, comb. nov. Basionym: *Tupistra chinensis* Baker, in Hooker, Icon. Pl. 19: t. 1867. 1889. *Campylandra chinensis* (Baker) M. N. Tamura, S. Yun Liang & Turland, Novon 10: 159. 2000. TYPE: China. [Hubei]: Patung [Badong] district, A. Henry 5023 (holotype, K photo).

*Other selected specimens examined.* CHINA. **Hubei:** Xingshan (Wanchaoshan), 1700 m, 8 May 1982, Z. D. Jiang & G. F. Tao 198 (A). **Szechwan [Sichuan]:** Nanchuan Hsien, 7000–8000 ft., 26 May 1928, W. P. Fang 946 (GH).

***Rohdea delavayi*** (Franchet) N. Tanaka, comb. nov. Basionym: *Tupistra delavayi* Franchet, Bull. Soc. Bot. France 43: 40. 1896. *Campylandra delavayi* (Franchet) M. N. Tamura, S. Yun Liang & Turland, Novon 10: 159. 2000. TYPE: China. Hupeh [Hubei]: Ichang, Mar. 1889, A. Henry 5231A (lectotype, designated here, P; isotype, E).



*Other selected specimen examined.* CHINA. **Yunnan:** "les bois à Outchay, près de Ta kouen," 19 Mai 1882, A. P. J. M. Delavay (type, P).

**Rohdea emeiensis** (Z. Y. Zhu) N. Tanaka, comb. nov. Basionym: *Tupistra emeiensis* Z. Y. Zhu, Acta Bot. Yunnan. 4: 271. 1982. *Campylandra emeiensis* (Z. Y. Zhu) M. N. Tamura, S. Yun Liang & Turland, Novon 10: 159. 2000. TYPE: China. Sichuan: Emeishan, 1800–2500 m, 1 June 1976, D. Q. Li & Z. Y. Zhu 29 (holotype, EMA not seen).

No specimen seen.

**Rohdea ensifolia** (F. T. Wang & Ts. Tang) N. Tanaka, comb. nov. Basionym: *Tupistra ensifolia* F. T. Wang & Ts. Tang, Bull. Fan Mem. Inst. Biol. 7: 86. 1936. *Campylandra ensifolia* (F. T. Wang & Ts. Tang) M. N. Tamura, S. Yun Liang & Turland, Novon 10: 159. 2000. TYPE: China. Yunnan: Tengyueh, 6–7000 ft., June 1912, G. Forrest 8455 (lectotype, designated by Tamura et al. (2000), K photo; isotype, E).

*Other selected specimens examined.* CHINA. **Yunnan:** Shunning, Hila, 2300 m, 26 June 1938, T. T. Yü 16479 (A, E).

**Rohdea eucomoides** (Baker) N. Tanaka, comb. nov. Basionym: *Gonioscypha eucomoides* Baker, J. Linn. Soc., Bot. 14: 581. 1875. TYPE: Bootan [Bhutan]. Aka or Daphla Hills, 2 Nov. 1850, T. J. Booth s.n. (holotype, K photo).

*Other selected specimens examined.* INDIA. **Assam:** Jamiri, Balipara Frontier Tract, 4000–5000 ft., 1935, F. Kingdon-Ward 12470 (BM). [**Arunachal Pradesh**]: Daphla Hills, 4500 ft., 28 Dec. 1874, J. L. Lister 132 (K).

**Rohdea jinshanensis** (Z. L. Yang & X. G. Luo) N. Tanaka, comb. nov. Basionym: *Tupistra jinshanensis* Z. L. Yang & X. G. Luo, Acta Bot. Yunnan. 6: 389. 1984. *Campylandra jinshanensis* (Z. L. Yang & X. G. Luo) M. N. Tamura, S. Yun Liang & Turland, Novon 10: 159. 2000. TYPE: China. Sichuan: Omei (cult. in Sichuan School of Chinese Materia Medica), 450 m, 12 Apr. 1983, X. G. Luo & Z. L. Yang 483053 (holotype, EMA not seen).

No specimen seen.

**Rohdea longipedunculata** (F. T. Wang & S. Yun Liang) N. Tanaka, comb. nov. Basionym: *Tupistra longipedunculata* F. T. Wang & S. Yun Liang, in F. T. Wang & Ts. Tang, Fl. Reipubl. Popularis Sin. 15: 249. 1978. *Campylandra longipedunculata* (F. T. Wang & S. Yun Liang) M. N. Tamura, S. Yun Liang & Turland, Novon 10: 160. 2000. TYPE: China. Yunnan: Tsin-hung, Cheli, Sheau-meng-yeang, 960 m, Sep. 1936, C. W. Wang 75985 (holotype, PE; isotype, IBSC).

*Other selected specimens examined.* CHINA. **Yunnan:** Tsang-Yuan, 1400 m, Apr. 1936, C. W. Wang 73338 (A); Keng-Ma, 1620 m, Apr. 1936, C. W. Wang 72934 (A); original locality unknown, cultivated in Kunming Inst. Bot., 5 Nov. 1992, H. Li, N. Tanaka & T. J. Xiao 356 (TEU).

**Rohdea tonkinensis** (Baillon) N. Tanaka, comb. nov. Basionym: *Tupistra tonkinensis* Baillon, Bull. Soc. Linn. Paris 2: 1116. 1893. TYPE: [Vietnam]. Tonkin. Vallée de Lankok, Mont Bavi, July 1887, B. Balansa 4142 (holotype, P).

*Other selected specimen examined.* CHINA. **Yunnan:** Marlipo, Tung-ting, 1000–1200 m, 18 Nov. 1947, K. M. Feng 13384 (A).

Liang and Tamura (2000) treated this species (under the name *Tupistra tonkinensis*) as a synonym of *Campylandra wattii* C. B. Clarke. However, so far as I can ascertain, scaly leaves on the stem of *Rohdea tonkinensis* are consistently absent except those at the base of the scape, which is terminally borne on the stem. This feature seems to distinguish *R. tonkinensis* from all other species of the genus.

**Rohdea verruculosa** (Q. H. Chen) N. Tanaka, comb. nov. Basionym: *Tupistra verruculosa* Q. H. Chen, Acta Phytotax. Sin. 25: 69. 1987. *Campylandra verruculosa* (Q. H. Chen) M. N. Tamura, S. Yun Liang & Turland, Novon 10: 160. 2000. TYPE: China. Guizhou: Pingtang, Bairu, 700 m, 13 May 1982, Q. H. Chen & J. D. Liu 1328 (holotype, HGAS not seen).

*Specimens examined.* CHINA. **Kouy-Tcheou [Guizhou]:** "bois de Lhon-ly [spelling uncertain]," 2 Avr. 1911, J. Esquirol 2623 (K, P).

*Specimens of other species mentioned in this paper.* **Gonioscypha muricata:** LAOS. Pak-lay, 1866–1868, C. Thorel 3314 (holotype, P). **Rohdea japonica:** JAPAN. **Tôkyô-to:** Tama-shi, 16 Dec. 1993, cult. in Teikyo Univ., 1 June 1997, N. Tanaka s.n. (TEU). **Tupistra albiflora:** THAILAND. Mae Tamang, 900 m, 1984, T. Yahara s.n., cult. in Bot. Gard., Univ. of Tokyo, then cult. in Teikyo Univ., 10 Dec. 1995, N. Tanaka s.n. (TEU). **Tup-**



**istra fungilliformis**: CHINA. Yunnan: Malipo, Mt. Laojunshan, without record of collector and date, cult. in Kunming Inst. Bot., 25 Oct. 1992, H. Li, N. Tanaka & T. J. Xiao 23 (TEU).

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